

DEPARTMENT OF AGRICULTURE

CENTRAL EXPERIMENTAL FARM
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EMMER AND SPELT

BY

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To the Honourable
The Minister of Agriculture.

SIR,—I have pleasure in submitting for your approval Bulletin No. 45 of the Experimental Farm series on Emmer and Spelt, which has been prepared under my direction by Dr. C. E. Saunders, Experimentalist.

In this bulletin descriptions of a number of varieties are given of emmer and spelt, and the results of many experiments submitted which have been conducted with these cereals at the experimental farms.

Much interest has been awakened of late among farmers in this country in the growing of emmer and spelt, and in the bulletin herewith presented, many facts are brought together regarding the proportion of hull to kernel and the relative usefulness and cropping power of emmer and spelt in comparison with other cereals.

To make the information more complete some analyses have been made by the Chemical Division of the kernels and hulls of emmer and spelt, which show the relative nutritive value of these materials.

I have the honour to be,
Your obedient servant,

WM. SAUNDEKS,
Director of Experimental Farms.

OTTAWA, June 28, 1904.

EMMER AND SPELT.

The classification of the different varieties of wheat, and of those cereals closely related to wheat, has been attempted in various ways by botanists; and opinions are divided as to whether emmer and spelt can fairly be classed as varieties of wheat or not. The classification perhaps most commonly accepted recognizes wheat as occurring under three distinct species: *Triticum Polonicum*, *T. monococcum* and *T. sativum*. The last named species is divided into three sub-species as follows: *T. sativum spelta*=Spelt (Epeautre in French) *T. sativum dicoccum*=Emmer (Amidonier in French) and *T. sativum tenax*=common wheat.

For the purposes of this bulletin it is unnecessary to discuss at length the question of classification, but we may conveniently use the divisions as given above, employing the term 'spelt' for those varieties of cereals included under the sub-species *T. sativum spelta* and the term 'emmer' (a German word for which there is no English equivalent) for those coming under *T. sativum dicoccum*. For the sake of simplicity it seems desirable to include under the term 'emmer' the species *T. monococcum*, which, however distinct from a botanical point of view, certainly bears a strong resemblance to some of the varieties of *T. sativum dicoccum*.

Although closely related to true wheat, both spelt and emmer are in a commercial sense quite distinct from it, and should be compared rather with oats and barley. While it is no doubt possible to make flour from emmer and spelt, it is extremely improbable that this will ever be done in America. Meanwhile, these grains are being used for the feeding of cattle, &c and it is for such purposes that they deserve consideration.

GENERAL DESCRIPTION.

The most striking characteristic of spelt and emmer, which distinguishes them at once from all the true wheats, is the fact that the chaff adheres to the grain after it has passed through an ordinary threshing process. If the operation is very severe a proportion of the grain will be threshed out clean, but not enough to leave any doubt as to the identity of the sample. This peculiarity is due both to the tightness with which the chaff clings to the grain and to the unusual brittleness of the stem (or rachis). The grain itself is usually long, of rather large size and very hard, resembling the macaroni wheats (of which Goose is our commonest example in Canada), rather than the ordinary wheats. The straw of the emmers and spelts varies in character. In emmer it is usually rather short and thin, and sometimes is not sufficiently strong to prevent lodging of the grain. In spelt the straw is coarser.

DISTINCTIONS BETWEEN EMMER AND SPELT.

Various points of difference between emmer and spelt might be given, but it will be sufficient to mention two or three of the most striking. The heads of emmer are essentially short, compact and flat, the spikelets being set very close together; while the heads of spelt are long and open, the spikelets being set quite far apart. All the emmers are bearded, but some of the spelts are beardless. Spelt is generally of coarser type than emmer and the proportion of husk present in the threshed grain is usually larger.

WEIGHT PER BUSHEL.

The weight of a measured bushel of emmer or spelt depends largely on the variety and on the way in which it has been threshed; loose kernels, if present, materially increase the weight. Roughly speaking, one may say that emmer generally weighs from 30 to 38 lbs. and spelt from 22 to 30 lbs. per measured bushel.

SPECIAL POINTS OF MERIT.

Both emmer and spelt have been found, so far as tested at the experimental farms, to be as a rule comparatively free from rust. It is also generally believed that they withstand drought very well, and will thrive on soil which is too light to give a good crop of wheat. These most desirable characteristics certainly show that these cereals merit the attention of Canadian farmers in some sections of the country; but they do not, as is sometimes assumed, demonstrate the superiority of emmer and spelt to wheat, oats and barley.

PRINCIPAL VARIETIES OF EMMER AND SPELT.

Most of the varieties mentioned in this bulletin are practically unknown in Canada and do not possess recognized English names. It has been found necessary, therefore, to give suitable names to them. The descriptions and wood cuts will serve to identify the varieties in cases where any of them are already known under other names. The wood cuts are made direct from photographs and show the actual size of the heads, except that in some cases the awns are not represented in their full length. The tests which are being carried on at the Dominion Experimental Farms in regard to the relative productiveness of emmer and spelt do not yet permit the drawing of any definite conclusions; but it appears that Common Emmer (the variety generally grown) will hold its place as one of the best sorts.

Six varieties of emmer and five varieties of spelt are here described. The length of stem, length of head, &c., given in the descriptions refer to the grain as produced at Ottawa. The figures are to be taken as approximate only, and are useful rather in a relative than an absolute sense.

Common Emmer (Fig. 1).—This variety is also known as Ufa Emmer, and commonly but incorrectly called 'speltz' in America. This latter word is a misapplied corruption of the German word 'spelz.' The name White Emmer has also been used for this variety, but White Emmer and Common Emmer, as described in this bulletin, are distinct varieties. Kernels reddish in colour, pointed at both ends, rather large and very hard. (100 kernels weigh about 3 to 3½ grammes.)*

Gluten lacks elasticity.

Heads bearded, about 2 to 3 inches long.

Chaff smooth, pale yellowish, (that is "white" as the term is commonly used.)

Straw thin, but usually sufficiently strong for the weight of the heads. Straw (including heads) about 35 to 50 inches long.

Ripens about mid-season (as compared with wheats.)

The threshed grain usually contains about 78 per cent to 79 per cent of kernel, and 22 per cent to 21 per cent of husk. Loose kernels, if present, will of course materially alter these proportions.

White Emmer.—This variety resembles Common Emmer, but is distinguished from it by having a somewhat larger head and being later in ripening.

Kernels reddish, large, pointed, hard. (100 kernels weigh about 3 grammes).

Gluten only slightly elastic.

* 100 kernels of Red Fife commonly weigh about 3.1 grammes.



Fig. 1.—COMMON EMMER.



Fig. 2.—SINGLE EMMER
(*Triticum monococcum*.)

Heads bearded, about $2\frac{1}{2}$ to $3\frac{1}{2}$ inches long.

Chaff very pale yellowish, smooth.

Straw thin, but stiff, about 38 to 48 inches long.

Ripens late (about a week later than Common Emmer).

This variety is sometimes considerably affected by rust.

The threshed grain usually contains about 76 per cent of kernel and 24 per cent of husk.

Long Emmer (Fig. 3).—This has perhaps the longest head of all the emmers, but it preserves the essential characteristics of this class of cereal, the head being distinctly flattened and the spikelets close together.

Kernels reddish, very large, pointed, very hard. (100 kernels weigh about 4 grammes).

Gluten very dark and strikingly deficient in elasticity.

Heads bearded, about $3\frac{1}{2}$ to $4\frac{1}{2}$ inches long.

Chaff yellowish, smooth.

Straw stiff, about 40 to 50 inches long.

Ripens very late, about two weeks later than Common Emmer.

The threshed grain usually contains about 74 per cent of kernel and 26 per cent of husk.

Red Emmer.—This variety resembles Long Emmer in many ways, but is easily distinguished by its reddish chaff.

Kernels red, large, pointed, hard. (100 kernels weigh about 3 to $3\frac{1}{2}$ grammes.)

Gluten very deficient in elasticity.

Heads bearded, about 3 to $4\frac{1}{2}$ inches long.

Chaff a rather dark reddish colour, smooth.

Straw stiff, about 40 to 50 inches long.

Ripens late, about a week later than Common Emmer.

The threshed grain usually contains about 75 to 78 per cent of kernel and 25 to 22 per cent of husk.

Thick Emmer (Fig. 4).—This is readily distinguished by the fact that the tip of the head is thickened somewhat after the manner of the Club wheats.

Kernels reddish, large, pointed, very hard. (100 kernels weigh about $3\frac{1}{2}$ or 4 grammes).

Gluten not of good quality, deficient in elasticity, but superior to some of the other emmers.

Heads bearded, about $2\frac{1}{2}$ to $3\frac{1}{2}$ inches long, thickened at the tip.

Chaff reddish, smooth.

Straw stiff, about 34 to 48 inches long.

Ripens approximately with Common Emmer.

The threshed grain usually contains about 73 per cent of kernel and 27 per cent of husk.

Single Emmer.—*Triticum monococcum* (Fig. 2).—This variety is characterised chiefly by the small size of the head and by having only one kernel in each spikelet.

Kernels red, small, flattened, rather soft. (100 kernels weigh about 2 to $2\frac{1}{2}$ grammes.)

Gluten dark and remarkably poor.

Heads bearded, about $2\frac{1}{2}$ to $2\frac{3}{4}$ inches long, very much flattened and with the spikelets remarkably close together. Awns delicate.

Chaff yellowish, smooth.

Straw thin but stiff, about 38 to 45 inches long.

Ripens very late, too late to be popular for general cultivation.

The threshed grain usually contains about 73 per cent of kernel and 27 per cent of husk.



Fig. 3.—LONG EMMER.



Fig. 4.—THICK EMMER.

Double Emmer.—This variety appears to be essentially the same in most respects as Single Emmer. It, however, often contains two kernels in a spikelet. It is not so late in ripening as Single Emmer.

White-bearded Spelt (Fig. 5.)—This possesses a long, coarse head with stiff awns, and spikelets set far apart.

Kernels reddish, rather large and moderately hard. (100 kernels weigh about $3\frac{1}{2}$ grammes.)

Gluten of rather poor quality.

Heads bearded, about 4 to 6 inches long.

Chaff yellowish, smooth.

Straw stiff, 34 to 48 inches long.

Ripens about mid-season (as compared with ordinary wheats.)

The threshed grain usually contains about 72 or 73 per cent of kernel and 28 or 27 per cent of husk.

Black-bearded Spelt.—This closely resembles White-bearded Spelt, but the awns (and sometimes the chaff) are dark in colour. This dark colour is, however, not constant, varying in different seasons and climates from dull reddish to almost pure black.

Kernels reddish, rather large. (100 kernels weigh about 3 to $3\frac{1}{2}$ grammes.)

Gluten of good quality.

Heads bearded, about $4\frac{1}{2}$ to $6\frac{1}{2}$ inches long.

Chaff and awns vary in colour from dull reddish to black; chaff smooth.

Straw fairly stiff, about 38 to 48 inches long.

Ripens with White-bearded Spelt.

The threshed grain usually contains about 71 to 78 per cent of kernel and 29 to 22 per cent of husk.

White Spelt (Fig. 6.)—This is a beardless variety, otherwise resembling White-bearded Spelt in most respects.

Kernels reddish, rather long, not very hard. (100 kernels weigh about 3 to $3\frac{1}{2}$ grammes.)

Gluten of very fair quality.

Heads beardless, about $4\frac{1}{2}$ to $6\frac{1}{2}$ inches long.

Chaff pale yellowish, smooth.

Straw stiff, about 45 to 50 inches long.

Ripens with White-bearded Spelt.

The threshed grain usually contains between 62 and 70 per cent of kernel and between 38 and 30 per cent of husk.

Smooth Spelt.—This is a beardless variety resembling White Spelt and scarcely to be distinguished from it except when the varieties are growing near together.

Kernels reddish, rather long and not very hard. (100 kernels weigh about 3 to $3\frac{1}{2}$ grammes.)

Gluten of good quality.

Heads beardless, about $4\frac{1}{2}$ to $6\frac{1}{2}$ inches long.

Chaff pale yellowish, smooth.

Straw stiff, about 45 to 50 inches long.

Ripens somewhat later than White Spelt.

The threshed grain usually contains from 67 to 73 per cent of kernel and from 33 to 27 per cent of husk.

Red Spelt.—This variety resembles White Spelt in most respects, but is distinguished from it by the colour of the chaff.

Kernels reddish, large, rather long, not very hard. (100 kernels weigh about 3 to $3\frac{1}{2}$ grammes.)



Fig. 5.—WHITE BEARDED SPELT.



Fig. 6. -WHITE SPELT.

Gluten of good quality.

Heads beardless, about 3½ to 5½ inches long.

Chaff reddish, smooth.

Straw stiff, about 45 to 50 inches long.

Ripens somewhat later than White Spelt.

The threshed grain usually contains about 70 per cent of kernel and 30 per cent of husk.

NEW HYBRIDS OF EMMER.

A number of new hybrids have been produced by the writer of this bulletin during the last few years, by crossing different sorts of emmer with varieties of wheat. The results thus obtained are of considerable interest. Some of the new varieties produced by crossing Common Emmer with Colorado wheat are very strong and productive, but the work has not been carried on long enough to decide as to their precise value, and whether or not they are worthy of being introduced for general cultivation.

CULTIVATION OF COMMON EMMER.

Of all the varieties of emmer and spelt described, this is the only one which is known (to any extent) to the farmers of Canada. On this account and because of the marvellous claims made for this cereal by certain interested individuals it seems best to consider carefully the methods of cultivation, the uses and the value of Common Emmer.

Soil and Climate.—So far as the tests at the Experimental Farms have gone, it appears that emmer requires about the same methods of cultivation as other cereals, but that it will thrive on lighter soil and will withstand drought very well. Where the rainfall in July and August is plentiful, emmer does not, as a rule, give a very large crop. This most important fact is sometimes overlooked. In some instances the success of emmer in south-western Ontario has been used as an argument for its cultivation in north-eastern Ontario, Quebec and elsewhere, where the rainfall during July and August is usually considerably greater. The value of emmer in the latter localities is, to say the least, quite doubtful, and its cultivation can be recommended only as an experiment.

Quantity to Sow.—Experiments conducted at the Brandon Experimental Farm show that the best results are obtained by using between 80 and 90 lbs. of grain to the acre. As much as 100 lbs. to the acre might be used to advantage in cases where the seed is entirely free from loose kernels.

Emmer cut green.—Common Emmer is sometimes cut green and dried for fodder. It has considerable value in this form, but great care must be exercised not to allow the crop to approach too closely to maturity before cutting, as the awns on the emmer heads sometimes make the fodder most objectionable if they are well developed.

Ground Emmer.—Probably the best way in which to make use of emmer is to grind the threshed grain (with husk adhering). When prepared in this manner it makes an acceptable and valuable food for animals.

EMMER COMPARED WITH WHEAT.

Comparisons between wheat and emmer are often made in such a manner as to be extremely misleading. The bushel of emmer (at 34 lbs. or some such weight) is sometimes compared with the bushel of wheat (at 60 lbs.), and even when the grains are compared on the basis of the actual weight of crop produced, it is not customary to make any allowance for the chaff present in the emmer. It is easy by such means to show great superiority on the part of the emmer. In view of these facts a few comparisons on a fair basis may not be without value.

Common Emmer usually contains about 21 or 22 per cent of husk, but, when occasional free kernels are present, the percentage is less. For the purpose of comparing the yield with that of wheat we may reckon the husk at 20 per cent, thus giving the emmer the benefit of the doubt.

Ottawa, Ont.—Calculated in this way, we find that during the years 1901, 1902 and 1903 (the full length of time for which figures are available), the average yield per acre at the Experimental Farm at Ottawa of emmer and of four varieties of wheat has been as follows:—

Common Emmer (kernels).....	1,176 lbs. per acre.
Goose (macaroni wheat).....	1,577 " "
Roumanian (macaroni wheat)	1,857 " "
Red Fife wheat.....	1,861 " "
Preston wheat.....	2,033 " "

In so far as the last three seasons can be taken as representative, the records show emmer to be strikingly less productive than the best varieties of wheat in the climate of Ottawa.

Nappan, N.S.—A similar comparison for the last four years at the Nappan Experimental Farm gives the following figures:—

Common Emmer kernels.....	1,696 lbs. per acre.
Goose.....	1,910 " "
Roumanian.....	2,200 " "
Red Fife.....	2,240 " "
Preston.....	2,210 " "

The great inferiority of emmer, as regards yield, in the climate of this part of Nova Scotia, is here clearly demonstrated.

Brandon, Man.—A comparison of the records for the last four years at the Brandon Experimental Farm shows as follows:—

Common Emmer kernels.....	2,034 lbs. per acre.
Goose.....	2,468 " "
Roumanian.....	2,245 " "
Red Fife.....	1,725 " "
Preston.....	1,450 " "

Here we find that Common Emmer has given a yield considerably greater than either of the varieties of wheat grown for the production of flour, but not so large a yield as the best macaroni wheats.

Indian Head, N.W.T.—A comparison for the same years at the Indian Head Experimental Farm gives the following average results:—

Common Emmer kernels..	2,056 lbs. per acre.
Goose.....	2,563 " "
Roumanian.....	2,355 " "
Red Fife.....	2,328 " "
Preston.....	2,468 " "

At this farm the yield of emmer is lower than that of any of the four varieties of wheat.

Agassiz, B.C.—The averages of the crop returns for the last years at the Experimental Farm at Agassiz are as follows:—

Common Emmer kernels.....	1,808 lbs. per acre.
Goose.....	2,477 " "
Roumanian.....	2,667 " "
Red Fife.....	2,495 " "
Preston.....	2,622 " "

In this case the yield of emmer is much below that of the four varieties of wheat.

SUMMARY OF COMPARISONS BETWEEN EMMER AND WHEAT.

It will be seen from the figures given above that emmer has been distinctly less productive than the best wheats, except at Brandon, where, although it yielded more than Red Fife and Preston, it was still inferior in crop to Goose and Roumanian. Though these conclusions are drawn from a comparatively small series of tests (three or four years) and are not, therefore, to be regarded as final, they indicate clearly that Common Emmer cannot generally be depended upon to give as large a crop of grain as the most productive varieties of wheat.

COMMON EMMER COMPARED WITH OATS AND BARLEY.

In order to arrive at a fair basis for comparison among these cereals, it is necessary to deduct from each the amount of husk or chaff present. This is here reckoned at 30 per cent for Banner oats, 12 per cent for Mensury barley and 20 per cent for Common Emmer. Of course, this material is not by any means worthless for feeding purposes, nor is it strictly accurate to assume that equal weights of the kernels of these different grains are of equal nutritive value. The analyses of Banner oats published in the Report of the Experimental Farms for 1903, page 135, and the analyses given at the end of this bulletin show considerable differences in composition in the kernels of these different classes of cereals. The kernels of Banner oats, for instance, contain relatively a very large percentage of fat; and both Banner oat kernels and the kernels of Common Emmer contain a distinctly higher proportion of albuminoids than the kernels of Mensury barley. In carbohydrates, however, barley kernels are better than those of oats, and perhaps superior to Common Emmer also. The full discussion of these differences would require more analytical data than are at present available; and no attempt will therefore be made in this bulletin to state with precision the relative values of equal weights of the kernels of these cereals.

Ottawa, Ont.—The averages of the returns of the past three years at the Experimental Farm at Ottawa are as follows:—

Common Emmer kernels.....	1,176 lbs. per acre.
Mensury barley kernels.....	2,000 " "
Banner oat kernels.....	1,596 " "

These differences are very striking, and show the marked inferiority of the emmer in this climate.

Nappan, N.S.—The averages in this case are calculated from the yields obtained for four years:—

Common Emmer kernels.....	1,696 lbs. per acre.
Mensury barley kernels.....	2,394 " "
Banner oat kernels.....	1,925 " "

These results are similar to those obtained at Ottawa.

Brandon, Man.—At the Experimental Farm at Brandon the plot of Mensury barley failed in 1902 and the plot of Banner oats was almost a total failure in 1900, so that a fair basis for comparison with Common Emmer is difficult to arrive at unless we omit the year 1902 when considering the barley, and the year 1900 when considering the oats. Calculated in this way we find that Common Emmer gave 2,158 lbs. per acre of kernels, as compared with 2,264 lbs. for Mensury barley. On the other hand, Common Emmer gave 1,982 lbs. per acre of kernels, as compared with 1,904 lbs. for Banner oats.

Indian Head, N.W.T.—The comparisons made at the Experimental Farm at Indian Head are based on the crops obtained in the last four years:—

Common Emmer kernels.....	2,056 lbs. per acre.
Mensury barley kernels.....	2,495 " "
Banner oat kernels.....	2,288 " "

Agassiz, B.C.—The average yields at this farm have been calculated from the returns for three years only:—

Common Emmer kernels.....	1,808 lbs. per acre.
Mensury barley kernels.....	2,511 " "
Banner oat kernels.....	1,918 " "

It will be observed that Mensury barley has given a larger yield than Common Emmer at all the experimental farms, and that the Banner oat has given a larger yield than Common Emmer at every farm except Brandon.

CONCLUSIONS.

The yield of Common Emmer obtained at the several Experimental Farms during the past three or four years has been shown to be almost uniformly lower than that of the best varieties of wheat, barley and oats; and it does not appear that in the climates represented by these farms the cultivation of this cereal will prove at all remarkably profitable. It must be noted, however, that the results obtained at Brandon are more favourable to the emmer than those obtained at the other farms. In the Brandon district emmer appears to rank approximately with oats and barley in productiveness, and by way of variety would no doubt prove of value as food for cattle. It should be observed also that, as none of the experimental farms are situated in a dry climate, the experience here recorded with regard to this grain is not to be accepted as a guide for districts where prolonged droughts are of frequent occurrence; yet even in such regions it is possible that some of the varieties of macaroni wheat would prove more productive than emmer, while yielding grain of similar character and perhaps of equal value for feeding purposes.

During the absence of the Chemist of Experimental Farms, Mr. F. T. Shutt, some analyses of emmer and spelt have been made for publication in this bulletin by the assistant chemist, Mr. A. T. Charron, and the second assistant chemist, Mr. H. W. Charlton. The results of this work are given in the following report prepared by Mr. Charron:—

REPORT OF THE CHEMICAL DIVISION ON ANALYSES OF EMMER AND SPELT

BY

A. T. CHARRON, M.A.,

Assistant Chemist, Dominion Experimental Farms.

The following table gives the results of a complete analysis of two varieties of emmer and two varieties of spelt. It has been thought desirable to analyse not only the grain with the hull as it comes from the threshing machine, but also the hulls and kernels after they have been carefully separated by hand.

COMPOSITION of Emmer and Spelt : Whole Grain, Kernels and Hulls.

Designation.	Proportion of Kernels and Hulls.	Moisture.	Albuminoids.	Fat.	Carbohydrates.	Fibre.	Ash.
Red Emmer—							
Whole grain		8.04	13.00	1.84	63.64	10.32	3.16
Kernels	77.82	9.07	15.93	2.12	67.84	2.83	2.21
Hulls	22.18	6.40	3.87	1.06	47.66	35.99	6.02
Common Emmer—							
Whole grain		9.81	12.31	2.41	62.10	9.86	3.51
Kernels	77.32	9.99	14.25	2.75	68.78	2.06	2.17
Hulls	22.68	7.55	3.44	1.07	43.60	35.76	8.58
Ped Spelt—							
Whole grain		8.33	12.31	2.03	59.26	14.09	3.98
Kernels	69.50	9.51	16.44	2.67	67.25	1.96	2.17
Hulls	30.50	7.50	5.81	0.59	45.64	34.51	5.95
White-bearded Spelt—							
Whole grain		7.48	12.19	1.90	61.77	13.05	3.61
Kernels	71.80	8.82	15.62	2.03	68.78	1.96	2.79
Hulls	28.20	5.37	4.69	0.77	47.67	35.86	5.70

It may be well to briefly state here the significance and relative importance of the various constituents determined by analysis.

Albuminoids.—This is the most important nutrient in all feeding stuffs, from the fact that it contains nitrogen, which is absent in all the other constituents of fodders. Nitrogen is indispensable to the animal for the formation of its flesh and the casein of milk.

Fat.—The fat or ether extract is the next most important constituent of feeding stuffs. Its principal function is the production of fat and heat. Owing to the high proportion of carbon it contains, fat is over twice as effective as the same weight of carbohydrates in producing heat.

Carbohydrates.—Under this name are included sugars, starch, gums, etc. Carbohydrates have the same function in the animal economy as fat.

Fibre.—This constituent is the least valuable in a fodder. It forms a very large proportion of the hulls, but serves a useful purpose in separating the more compact

particles of concentrated foods, rendering them more easily permeable to the digestive fluids.

The results in the table show that the feeding value of the kernels of spelt is somewhat higher than that of the emmer kernels. The hulls of spelt also have a slightly higher feeding value than those of emmer. But when the whole grain is considered the larger proportion of hull present in spelt makes it less valuable, weight for weight, than emmer.

In comparing the nutritive values of emmer and spelt with Mensury barley (the hulls being present in all cases) we find that the latter is very slightly superior. Recent determinations (made in the laboratories of this division) of the albuminoids in Mensury barley have given the following results:—

Albuminoids in whole grain....	12'50 per cent.
Albuminoids in kernels (free from hulls).....	12'75 "

From the foregoing data it is evident that red emmer (whole grain) is slightly superior to Mensury barley, but in the three other cases the barley seems to have the advantage. The kernels of emmer and spelt, however, contain about three per cent of albuminoids more than the kernels of Mensury barley.